The Latest Developments in Bank Burglary

New Scientific Devices Used by Burglars and How the Bankers Meet Them

By Edward H. Smith

IN THE year 1915 a strange thing happened in a little bank in Louisiana. On a Monday morning when the banker came down to open his doors and count his cash he found that some one had literally burned a hole in his safe, opened the locks and made off with the contents.

The banker was appalled. The shock would not have been so great had he found the thing blown open with explosives or even drilled open. But burned! Incomprehensible.

That neat little hole in the door of the safe of this small-town bank was a most significant and menacing phenomenon. It was, so far as I have been able to make out, the imprint of the first successful attack on any bank in the United States with the oxyacetylene torch.

This crime was not without its adumbrations. As early as 1908 or 1909 there appeared in Kansas City one J. G. Donaldson, who was equipped with an acetylene torch, in those days a new and somewhat fabulous instrument. Mr. Donaldson announced his belief that his fiery little tool would eat its way through burglar-proof safes with little difficulty and much despatch. A demonstration was duly staged in which the torch somehow failed to accomplish its disastrous purpose, greatly to the relief of safe makers and bankers. I mention Mr. Donaldson and his early disappointment because they have an important bearing on later and larger events.

Thus, before the event in Louisiana, there was a general feeling that banks and their funds stood in no special peril from the new tool. But after 1915 and its sudden development, there was an alarmed change of front. The bureau of the American Bankers' Association which deals with criminal attacks on banks forthwith issued a warning to its members and, what was more to the point, other burglarious applications of the torch followed.

On November 30, of the same year, an unsuccessful attack was made on the vault of the First National Bank at Osborne, Ohio, where the failure was due to an alarm which frightened the burglars away. In January of the following year, in the People's Bank at Petaskala, in the same State, the burglars had better luck, making off with about $2500. And so the torch menace to banks became a reality.

There was a general disposition to treat the new danger lightly and to minimize its possibilities. After all, the institutions attacked were small, their equipment was either antiquated or not of the best. Nor was this point of view without its temporary justification. The use of the torch by burglars did, in fact, develop slowly. It was all of five years before they succeeded against what could be termed a genuinely modern safe.

A vault burglary in Kansas City in 1922, in which the burglars used an acetylene torch to cut a man-hole from the bottom of the door. The picture shows the torch and gas tanks which were left behind

Looking back on the situation, it seems strange that more vision did not enter into the calculation of bankers. They might have resurveyed the beginnings of burglary with nitroglycerine in the United States, in which case they must have seen that here, too, the development was slow and the spread of the explosive to the hands of criminals a gradual one. It might have been foreseen that the possibilities of the torch had not been exhausted and that knowledge of its powers and its improved application would find its way to the criminal world tardily. But all this is so much spilt milk.

In November, 1920, a gang of burglars using an oxyacetylene torch managed to breach a modern manganese steel safe in the Farmers' State Bank at Shipshewana, Indiana. The banking fraternity and a good many conservative safe makers woke up in the next few days and began rubbing their eyes with agitated fingers. It was true, then. The pessimists had been right. The best kind of safe was no more invulnerable than its older relatives.

In the immediate following months other heavy manganese safes were burned open in Indiana, California, Oregon and then in many other States. The crisis had come.

It is this crisis which at present confronts the bankers and safe manufacturers of the country. When I last wrote about bank burglars in these pages, two years ago, I called attention to the torch and to its later complement, the fluxing rod, and dwelt upon the extent to which these instruments had entered into the calculations of the builders of bank vaults, such as those used by the Federal Government. Since that time, however, there have been distinct and highly important developments, both offensive and defensive. Before we can understand the significance of these developments, however, or get the fullness of their romantic flavor it is necessary to go back a bit into the history of safe making.

Since some time before the Civil War the American safe-maker has had two problems to deal with—the attacks of burglars who used the drill and those who used explosives. In the beginning these two destructive forces were in the same hands, since the method was to drill a hole into a safe by means of which it could be mined with black powder. Later, when nitroglycerine came into use, the drill became obsolescent but its potency could still not be disregarded by the safe-maker. His product had to be proof against all the known implements of attack.

To produce such safes was more easily said than done, for the two enemy forces required for their defeat a metal possessing the antagonistic and incongruous qualities of ductility and hardness. It was easy enough to make a metal hard enough to turn the drill but such metals were brittle and flew into shards before explosives. It was, likewise, not impossible to produce metals of sufficient ductility to offer a high resistance to explosives, but such metals were soft and the drill cut through them without much trouble.

One of the first types of burglar-proof safes consisted of several sheets of iron with steel springs, intended to turn the drills, placed between the sheetings. Their makers did not realize that it was an easy matter to drill through the outer sheet, fill the interstice with

The furnace at the Bureau of Standards in which safes are tested before receiving the government guarantee. They are dropped while hot from a height of forty to fifty feet. This process is then repeated before the safe is opened and the contents examined

A test attack on a new resistant metal with the acetylene torch and the fluxing rod. The man who handles the rod must wear a mask, an asbestos coat and asbestos gauntlets

A round door safe made of manganese steel. This metal embodies the long-sought combination of ductility and hardness. It was drill-proof but, as our illustration shows, it was not proof against the acetylene torch

powder and so blow off the first defense, giving immediate access to the second.

Next, came the much talked of five-ply steel, sometimes called chrome steel from the fact that the hard layers contained a small percentage of chromium. Five-ply steel is a name which describes the product, three layers of soft metal to give ductility and the two layers of hard metal to give hardness, laminated together. Nitroglycerine was readily used to blow these laminations apart.

Then came Franklynite or spiegeleisen, which was simply cast iron containing about 20 percent of manganese. This substance was used for making solid cast safes. It was drill proof but brittle and so its success was limited.

Back in the days of the powder burglar there was one other theory of defense used by the safe-maker, namely the plan of an outer shell or safe with an inner strong-box or burglar-proof chest. All these safes and chests were of laminated construction except a few cast-iron specimens, and were most happy and profitable arrangements for the nitroglycerine burglar.

As a result of nitroglycerine and its ravages, Corliss, the inventor of the steam engine which bears his name, made a series of experiments and evolved a very heavy type of safe of solid chilled cast iron with walls from six to twelve inches thick. He also invented the first liquid-tight door, a globular affair, which may still be seen in use here and there.

Nitroglycerine also forced other safe makers to trim their sails to the new wind. Indeed, it changed the whole structure of safes, and the round or screw door came into being, its design having been dictated by the fact that the "soup" burglar found it easy to let his nitro seep into the cracks of the old square-door safes, which could not be made to fit tightly enough to foil the burglars.

Then, however, came a metallurgical triumph which turned the accent of safe-makers quite away from structure and back to materials. Sir Robert Hadfield of Sheffield brought forward his manganese steel, a very different substance from the earlier spiegeleisen, which also contained manganese. Hadfield's metal was a steel alloyed with from 11 to 13 percent of manganese, the mass being heated to a temperature of from 1775 to 1850 degrees Fahrenheit and then plunged. This new manganese steel embodied in itself the long sought ideal combination of ductility and hardness. If cast in sufficient volume, it could not be breached with any usable amounts of explosive and it was drill proof to the limit of testing.

In America, three men brought this new metal into use for bank safes and introduced it to the country—Lieutenant Samuel Rodman, U. S. N., Sumner A. Ely and Henry D. Hibbard. These three men formed a firm and made the first manganese steel safes. They also fought a long and costly battle with the older safe makers and their screw-door laminated safes, in which the latter lost. In time all manufacturers had to come around to solid cast construction, which meant Hadfield's manganese steel.

This metal was used mainly for safe making but it was also being applied to vaults until about 1914, when the military demand for ferromanganese became so great and the prices went so high that it had to be temporarily abandoned as a safe and vault material.

I need hardly recount what triumphs were felt when manganese steel was introduced and a solid cast safe was finally to be had that could be neither blown nor drilled. The end of the bank burglar was once more predicted and not without some justification.

But, while the makers of manganese safes were exulting in their victory and busily installing their excellent product in banks all about the land, there came to these shores a Frenchman named Fouche, perhaps, by some sweet irony, a relative of Napoleon's iron chief of police of the same name. This modern Fouche wanted nothing of us but a patent on a welding torch which was based on the idea of burning acetylene in an atmosphere of oxygen.

Here we mark the beginning of a new and terrible foe to our cash boxes.

Two years later a Scandinavian named Jotram took out patents on a process for cutting steel by means of oxygen. His plan was to heat the metal to be cut to the point of redness with Fouche's torch and then to throw against this hot spot a jet of oxygen. This is, of course, the cutter-burner torch which has been used with deadly effect.

When safe-makers began to see what this slowly perfected new tool would do in industrial use and, when their efforts were quickened by the first attacks on safes, they moved out as rapidly as they could in the direction of resistant substances. Various things were suggested and tried—high carbon steel or cast iron, cast iron with an infusion of from 20 to 25 percent of copper, copper sheets from four to six inches thick in the doors of heavy vaults, and finally, various interlarded metals, usually a cast-iron matrix with some hard refractory substance in the center. The only one of these which reached any broad employment is of cast iron with a core of large sized crystals of the electric furnace carbides of silicon, alundum or aloxite.

In 1917, the late Francis J. Napolitan, a research engineer, invented the use of the fluxing rod, a thin bar of soft iron which is placed against the metal to be burned at the point where the torch flame strikes it, acting both as a fuel for the flame and as a scouring substance which can be made to bore into the heated and softened metal of the attacked surface. The experiments made on behalf of the government in November, 1919, with the torch and fluxing rod opened the eyes of engineers to the power of this new invention and the peril in which all existing vault and safe constructions stood. Since then still more violent and terrifying methods of attack have been devised, once more, not by the burglar but by the engineers applying their talents to industrial problems.

First of all, the oxyacetylene torch itself has been developed to much greater power and size than ever before. The giant welding torches now used industrially are capable of throwing big flames and getting up a heat against a resistant metal surface far

When Is a Safe Not Safe?

THE contest between the safe-cracker and the safe-maker is fast resolving itself into the old problem of the irresistible force and the immovable body—with the odds in favor of the safe-cracker.

Since the beginning of safe-making the inventors have had two sets of men to deal with—the burglars who use the drill and those who use explosives. Each new improvement of safes has been met, on the part of the burglar, with methods for successfully attacking it.

beyond anything that could have been foreseen a few years ago.

Second comes the pipe torch. This instrument is the invention of Mr. J. A. Mohr, head of the research department of the Carnegie Steel Company, who devised it to melt out the tapholes of "frozen" steel furnaces. It consists of a number of tanks of oxygen hitched to a long one-half or three-quarters-inch iron pipe. This pipe is heated to redness at the end. Then the stream of oxygen is allowed to flow through it. The red hot iron ignites the oxygen, which in turn burns up the iron pipe as fuel, generating a tremendous amount of heat, theoretically placed at 6940 degrees Fahrenheit.

Third, we must consider the so-called dog-house attack, an improvement on and development from the pipe torch. It was found by experimenters that in the use of the pipe torch against the smooth surfaces of high-resistance metals, such as are encountered in attacking a modern vault, a good deal of the heat was diffused and much of the iron fuel permitted to run off and be lost as It melted. Accordingly, the dog-house was improvised. It is no more than a box of graphite, measuring about eight by eight inches and six inches deep, with one surface open. It is fixed to the front or side of a vault or block of metal with wet fire clay or some other material along its free edges, thus making an enclosure. There is a hole in its facing surface through which the red-hot end of the pipe torch is introduced into the dog-house, a vent at the top for escaping gases and a small hole at the bottom through which excess accumulations of molten metal may flow off. Inside this chest of graphite the accumulated molten iron from the burning pipe and the oxygen flame unite in a frightful combustion, whose heat is confined to the spot of attack by the dog-house, thus minimizing the heat wastage.

Finally, the fourth new method of attack is to be found in what is called the regenerative torch. This onslaught is considered so deadly that I am cautioned against describing it beyond saying that it is capable of temperatures and destructive actions beyond those of any other torch.

So far as is known, none of these four recently devised tools has been used by a burglar. It must, however, be stated that there is nothing specially complicated about any of them and no reason why a burglar cannot employ one or all under favorable circumstances. How long it will be before such employment may be made is a question for the future.

What concerns us immediately is the possibility of devising a metal or other substance capable of resisting such violent and devastating onslaughts. It may be said that no safe now in use can hope to stand up before the more effective of these tools for more than a relatively few minutes. Indeed, they tear their fiery way through metal defences once considered impregnable in seconds rather than minutes.

There was a time when I was disposed to reason that no metal or combination of metals could hope to defy the power of the torches, for the reason that all metals or alloys had to be fused before they could be formed into safes, vaults or plates, and what could be fused once could naturally be fused again. A glance at the fusion points of various metals and other substances, compared with the heat of the oxyacetylene flame will seem to support this view. Cast iron, for instance, melts at 2200 to 2400 Fahrenheit, steel at 2400 to 2600, manganese steel at 2600 to 2700, wrought iron at 3200 to 3300 and the best kind of fire bricks at 3700 to 3900. Carborundum sublimates at somewhere between 4200 and 4300, zirconium silicate at 4300 to 4350, the oxide between 4900 and 5000. Uranium fuses at about 4350 degrees, osmium at 4980, tungsten at 6020 and even carbon at 6500. These latter are approximate figures. On the other hand, the oxyacetylene flame has a theoretical temperature of 7878 degrees.

On the surface, it would seem that nothing could stand before such a torturing flame. But here the problem of heat waste intrudes itself. Radiation, conduction and convection carry off a great part of the heat energy of the torch flame, especially when the attempt is made to attack a great vault door or very heavy safe with a relatively small point of heating such as can be got from even a large modern torch. The mass of metal "absorbs" and wastes a great part of the heat; just how much is not known. In this fact was found the hope of devising materials which would successfully resist those tremendously high temperatures to be found in the torch flame.

Are We on the Eve of a Great Epidemic of Bank Burglaries?

RECENT defensive experiments and inventions might lead us to forecast an end to bank burglary. But to bring this about in fact is not so easy. What concerns safe-makers immediately is the possibility of devising some metal or other substance capable of resisting the devastating onslaught of the various types of the acetylene torch, a high-temperature device which will eat its fiery way through metal defences once thought absolutely impregnable.

Here Mr. Donaldson re-enters the picture. His interest in the problems raised by the torch began, as I have said, about 16 years ago. At that time he was trying to attack safes with the torch. It was not long, however, before his interest veered to the other side and he commenced his experiments with resistant materials. Several years ago Mr. Donaldson appeared at Columbia University with the fruit of his earlier struggles and began a long continued series of laboratory experiments, assisted by Dr. Ralph H. McKee and Mr. Henry L. Coles of Columbia. After some years of research he retired to his own laboratories and there finally evolved a new set of composite metals, which he was finally able to work into solid casting, having a matrix of metal offering a high resistance to the drill, the practical explosives and the torch as well. Inside this matrix is a core of somewhat more costly amalgamated metals which possess still higher resistances.

This material, in the form of plates and castings has within the present year been subjected to the most exhaustive and gruelling tests in independent laboratories, which had been selected to do the testing by interested banks, insurance companies and the like. To some of these tests and demonstrations the writer has been a witness. The others he has studied in the reports of the testing engineers—and studied with an initial skepticism.

The Donaldson metals have turned, time and again, the largest power drills and successfully resisted all attacks with commercial explosives. The largest types of welding torches have been played upon these substances in relays for hours, with the result that the torch tips finally melted and backfired without making any impression on the attacked substances. I have personally seen them attacked with the pipe torch and graphite dog-house for long enough to eat up a 20-foot length of pipe and exhaust a whole battery of oxygen tanks. Still no result. I have seen the same form of attack literally shoot holes into all the other safe metals and compositions known to me. It was after these long series of attacks and demonstrations that the Donaldson materials were employed in the newly finished vaults of the Chemical National Bank in New York.

The romantic conversion of the inventor, from a salesman who wanted to demonstrate the power of the torch, to a metallurgist and experimenter who perhaps has found the means of definitely defeating the same torch and better ones, is surely not the least interesting chapter in the long history of safe making and safe breaking.

The whole thing raises two fascinating questions: First, are we on the eve of a great epidemic of bank burglaries? Second, will this expected wave be the last and will the bank burglar then pass out of the criminal picture, as have the road agent and the green goods man?

As to the first: There are, unless memory fails, between thirty and forty thousand banks in the United States and among them few are equipped to withstand attacks such as are now possible to the burglar. Fully 95 percent of them were either outfitted with their defensive apparatus before the torch was considered important or before such things as pipe torches and dog-houses were thought of.

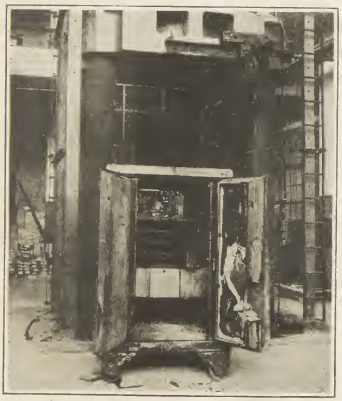
We must recognize that the torch in its present state of development is a much more powerful tool than nitroglycerine ever was, since it will open vaults and safes against which that explosive has always been useless.

And we must not forget the even more important factor of silence.

Many poorly equipped banks in both small and large towns and cities have been immune from burglarious attacks in the past because of advantageous location. That is to say, the banks were so situated with respect to other business houses, police stations, hotels and sleeping citizens that they could not be attacked with noisy explosives. All such banks become immediately vulnerable to the torch, which is as silent as a well oiled motor. It makes no more than a hiss and a shower of sparks, which may both be confined under a hood. Attacks with the pipe torch and the regenerative torch, of course, produce a veritable rain of sparks and a flow of brilliant molten metal, but even these phenomena are relatively silent and there is nothing about them to waken a sleeper in the next building or even on the floor above.

To meet this extreme peril there is nothing but the promise of new resistant materials such as those invented by Donaldson and his associates. Granting that these new metals are all they seem to be, there is still no hope that they can more than reduce the immediate danger. To install new torch-proof equipment in the thousands of exposed banks is, according to experience, a task which will require a good many years, even if the bankers all see the peril immediately and act to avert it.

These new metals are definitely beyond the fusing power of the most powerful torches and it is reasonable to suppose that metallurgy will keep pace with any possible further improvement of these powerful melting tools. On the other hand, invention may at any time produce entirely new methods of attack employing quite unsuspected physical forces. For the present, however, it may be said that the means of foiling the known tools of bank burglary seem to be at hand.



In the background of this illustration is shown the giant press used by the United States Bureau of Standards for testing the strength of safes

A burglar-proof chest or "kiester" with the entire back burned out by burglars who used the acetylene torch described in this article